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salesman's guide

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Salesman's Guide to EduSystem 10

1. Why Read This?

EduSystem 10 is a real breakthrough product. By running a true BASIC on a 4K PDP-8, it is the lowest-cost BASIC-speaking computer available anywhere. It's a powerful computer system that makes an electronic calculator look like a Dinky toy. At a price not much greater than that of some calculators! It's a system that supports high school and junior college curricula in math and science. And of course its expandable.

But.....it's a limited system as any 4K language must be. Not limited in language features. They're all there. Not limited in speed. It's surprisingly fast. But limited in program size. It's probably too limited to be of interest to schools which are now using computer terminals. Too limited to turn on the knowledgeable prospects which are DEC's traditional customers.

Why read this? To learn the limitations of EduSystem 10 and how to avoid them, then to learn the real attributes of the system and how to make them work for you.

2. Where did EduSystem 10 come from?

Back in 1968, or thereabouts, a school had two alternatives if it wanted to provide computer capability. It could rent a terminal from any number of commercial utilities, probably using BASIC, or could buy a 4K PDP-8 from DEC and use FOCAL. Schools did both, and both were very enthusiastic about their choices. Those using BASIC terminals liked the power and flexibility of a big machine. Those using FOCAL liked the subtlety of the language, the benefits of an on-site machine, and the long-range economy of owning their own equipment. But in both cases, these early school users were experienced, innovative, self-supporting teachers who knew and liked computers for their own sake. They developed their own curricula. These are the people who first showed why computers in the schools are a necessity, not a frill.

Today, and for many years to come, we will be seeing a second level of school computer users. These are schools which do not have innovative, computer-oriented teachers. They simply want to take advantage of the work which has already been done. They want to be told how the computer can be integrated into the curriculum. For a wide variety of reasons, they want BASIC. First, it is the most commonly used school language. Second, Dartmouth College has done a great deal of work in promoting BASIC and developing curriculum aids. Finally, and decisively, textbook publishers have decided to integrate computer programming into their next round of textbooks. They have universally chosen BASIC as the language for their texts.

The first of these new-breed math texts, Scott-Foresman's Computer Assisted Math Program (CAMP) illustrates an important point. The programs written and used in these programs are ridiculously small and unsophisticated. These facts, plus the obvious fact that school budgets are very tight, led DEC to develop EduSystem 10, the economy BASIC-box.

3. Who is the EduSystem 10 prospect?

The schools who will be interested in EduSystem 10 are rather well-defined. The most obvious candidate is the school that has no program in computers now, but has heard that they are good things, or are beginning to see the new computer-oriented texts coming out. No teacher in the school is particularly knowledgeable about or interested in computers *per se*. The school has no ambitions to develop new curricula. They want to fit the computer into their present courses as quickly and easily as possible. These schools do not want to be told about the revolutionary impact that a computer can have on their school. They need a few years of actual usage to find this out for themselves.

This customer has four alternatives: 1) rent a terminal, 2) buy a calculator, 3) buy an EduSystem 10, 4) do nothing. Option No. 4 remains the most popular. The first step is to convince this user that he cannot afford to do nothing. The way to do this is to show the school the things they can do with a computer that they cannot do otherwise. Use the demonstrations described in a later section to do this. Another popular alternative is to buy an electronic calculator. They are simple and inexpensive. The dumbest school can afford one; the dumbest teacher can use one -- and these are not points to belittle in this market. In general, selling against calculators by touting the esoteric features and possibilities of a computer does not work. Sell advanced features only to the limit of the customer's ability to absorb them. Do not over-estimate this ability. Sell against the calculator on the basis of EduSystem 10's easily learned language. To use the new textbooks, you must have BASIC, not Wang-speak. Sell this point hard. (Remember that Wang themselves have admitted as much. They are trying to make a BASIC computer system instead of calculators. Calculators are obsolete.) We should lose zero sales to calculators. Remember also that a programmable calculator costs upwards to $5000.

Okay, now the customer has two choices: rent a terminal or buy an EduSystem 10. This is probably the most difficult selling problem. To the beginner, a terminal, which involves buying nothing, having no computer to worry about, and the ability to cancel at any time, is attractive. In the back of his mind is the idea of "What if the computer doesn't work out?" Also, most of the schools who are established computer users started out with time-sharing terminals.

The important point to impress on the customer is that the computer will work out (anybody know of a school that had computer capability and decided to get rid of it?) Not only will it work out, but hundreds of schools across the country are proving that it will grow and flourish. (Use Educational Media reprint to reinforce this point.) Only by buying the computer will a school be able to afford to expand their facilities as their needs grow. Point to schools which started on terminals, then had to go out and buy their own machines. (TSS/8's at Lexington High School, Needham High, South Portland High, Berkshire Community College, and three more on Long Island all replaced terminals. Many, many smaller systems have been installed for the same reason.) They started with terminals, then, after spending ten thousand or more on rentals, realized their mistake. Impress the prospect that he can learn by the mistakes of the pioneers. Instead of throwing money away on terminals which will have to be replaced by an inhouse machine anyhow, start out by buying a machine. The customer must be made to realize this point.

So now we're down to EduSystem 10. Or are we? Yes! We're down to EduSystem 10! No other computer manufacturer offers a BASIC system at this price. Wang and Data General only have multi-user systems. But if these catch the customer's eye, we should be selling EduSystem 20 instead. In short, the EduSystem 10 prospect is now an EduSystem 10 customer. Code the P.O. as Product Line 83.

4. Who is NOT the EduSystem 10 prospect?

As described in the previous section, the EduSystem 10 prospect is the school with no previous computer experience who wants to get a program going. Seeing that other schools have found terminals an expensive dead-end, they are starting out with their own machine. So what about the school that has a terminal and is now ready to replace it with an inhouse computer? Are they a prospect for EduSystem 10? In all likelihood, NO!

Virtually all commercial utility terminals hook into big machines that offer a BASIC that is very fast, has bells and whistles (strings, files, matrices, etc.), and run very long programs. These people have been spoiled. They are willing to give up some of this capability (a school doesn't need the capabilities of a PDP-10 class machine), but are not willing to go all the way down to EduSystem 10. They consider themselves to be computer pros. (And they generally are.) EduSystem 10 is an insult to them and they will say so quickly. Therefore, don't sell EduSystem 10 to an established computer user. To do so will turn him off on DEC and you and jeopardize our chance to sell something bigger. Sell EduSystem 20 here! (Note: see section 6 for a further discussion of these prospects.)

5. More About Calculators

EduSystem 10 is not a replacement system for a time-sharing terminal. It is, however, a replacement for any electronic calculator ever made. And no one will realize this faster than the school that owns one. A school with a calculator is a downright fun place to show off EduSystem 10. The educational benefits of the computer are both numerous and obvious. A teacher who has been limited by a calculator (no hard copy, no text output, no programming or tiny machine level programming, no place to expand to) will instantly warm to the possibilities of EduSystem 10 BASIC. Obviously, it is possible to waste a lot of time with this kind of situation. The school, if it owns the calculator, may not be able to afford a computer as well. Or the teacher may have fought hard to get the calculator and be afraid to go back to the school board and say it was a mistake. But where a calculator is vulnerable, pounce on it!

Obviously, the time to shoot down a calculator is before it goes in. We should be competing for all calculator business, either by showing the customer that he really wants a computer or by bidding an EduSystem 10 Calculator. Point out that a computer can be expanded, a calculator cannot. And an EduSystem 10 is a breeze to work with compared to a calculator.

6. Who is NOT the EduSystem prospect, but will buy one anyway?

Even though EduSystem 10 is not a replacement for a time-sharing terminal, many schools will buy one for this purpose. They won't like it, but they'll do it because of the cold realities of a budget. Some schools can up their budget from one commercial terminal to two, and maybe even three. At this point, without increasing the budget at all, they can buy an EduSystem 20 or 40 (or 50) to replace the terminals. Other schools will get one terminal, but will not increase the budget for a second. The only way the school can hope to get multiple terminals is to buy an EduSystem 10, then expand it. They will accept the lesser capability in order to get multiple terminals in the future.

FOCAL can help in these sales situations. The customer is a realist. He is taking the EduSystem 10 route because of the economics. But he is worried that it won't run big enough programs for some of his needs.

In many instances, these programs can be run in FOCAL, which makes more efficient use of a small machine. (Unlike BASIC, FOCAL was designed specifically for a mini-computer.) When used in this way, FOCAL is a powerful bonus capability. Use it, but don't try to ram it down the customer's throat. He doesn't want to be told that he has to convert to FOCAL. He wants to be told that FOCAL is available to help solve his problem.

7. What is EduSystem 10?

A description of the actual product has been left until last for a good reason. It's not that important. More than with any of our other systems, we're selling the concept rather than the actual features. The concept is that of a system which allows schools to get started in computers. We don't want to compare the product to other specific systems. We only compare it to calculators (or slide rules, or abaci, or fingers...) But, alas, the customer, once he is sold on the concept, will eventually want to know exactly what it does.

The EduSystem 10 BASIC is fast and complete. It is half interpreter/half compiler. It runs at the speed of the TSS/8 BASIC compiler, yet has the flexibility of the FOCAL interpreter. It has the direct, or "calculator" mode which allows the user to do calculations without having to write a program. All basic features of BASIC implemented in the other EduSystem BASICs (subroutines, double subscripts, functions, user defined functions, and random numbers, all standard BASIC commands) are available in EduSystem 10. In addition, it allows multiple statements to be put on a line. See the following section for details.

The limitation is in program size. There is no fixed, simple formula for program size. Number of characters, number of lines, number of constants and variables, and program complexity all matter. Like FOCAL, BASIC allows some or all of the functions to be deleted to increase program space. For a better feel in this area, use EduSystem 10 yourself and refer to the demonstration programs.

ABOVE ALL, EDUSYSTEM 10 IS A COMPLETE SCHOOL COMPUTER SYSTEM AND IT COSTS $7,390. IT IS MUCH MORE THAN JUST A PDP-8/e COMPUTER

EduSystem 10 is aimed at the school which has little or no previous computer experience. At best, they know BASIC. You can be sure that they don't know octal and aren't about to learn. Many will never learn how to toggle in the RIM. They also don't know much about programming. They need manuals, work-books, and sample programs. EduSystem 10 provides all these items. The breakdown of the system is as follows:

PDP-8/e with teletype	$6,490
KP8/e power fail	250
MI8-EA hardware RIM	500
EDU8-A programs/texts	150
	$7,390

All of these components are necessary to a smoothly functioning installation. You are not doing the customer or yourself a favor by stripping it down. It's a capital expenditure for the school either way. Support is always a problem with a beginner installation. The configuration listed is designed to keep this problem to a minimum.

8. Differences Between EduSystem 10 (E'10) and EduSystem 20 (E'20) BASIC

a. Program size differs and depends on functions loaded.

b. E'20 makes all functions available at all times. E'10 functions are selected when the software is loaded.

c. E'10 has no RANDOMIZE instruction. The sequence produced by the RND function does not start over each time a program is run.

d. There is no FIX function in E'10.

e. E'10 allows only one DEF per program. It may have a single argument.

f. E'10 has no TAB or CHR$ functions.

g. If no DIM statement exists, E'10 assumes a maximum subscript of 10.

h. E'10 has no ON-GOTO statement.

i. E'10 does not recognize RUBOUT. Use back arrow.

j. E'10 does not recognize the DELETE command. Erase single lines by typing their line numbers.

k. E'10 does not recognize NEW or BYE.

l. E'10 does not recognize the TAPE or KEY command. Leader on paper tapes is generated off-line, or by typing the HERE IS key.

m. E'10 does not recognize the EDIT command.

n. The LIST command in E'10 may not take two arguments. If one argument is present, LIST starts listing the program at that line.

These are the features that EduSystem 10 doesn't have. They are, however, compensated for by the great features which only EduSystem 10 has.

o. Direct mode is available in EduSystem 10.

p. E'10 allows multiple statements per line. Each is separated by "\".

9. Demonstrating EduSystem 10

Since the EduSystem 10 prospect has little or no real experience with interactive computers, the goal of a demonstration is to show him that:

a. The computer is easy to live with and simple to use. It won't be a headache once it's installed.

b. The computer is something he NEEDS. He needs it because it allows him to better teach the subjects he is teaching anyhow and it allows him to teach things which are impossible otherwise.

Since the prospect is a novice, he will be a little bit scared of the computer. For that reason, it is imperative that the system be all loaded and ready to go.

Note! When you load EduSystem 10, it asks which functions to keep. To use these demos, keep all of them except ATN (This is option 'C'). Subscripts begin at 1.

Note! If the system is stopped after it was loaded, restart it at 1000, not 0200.

The first step is to demonstrate simplicity and ease of use. The direct mode is perfect for this. Show the customer how he can get meaningful results from the computer without even writing a program. It is frequently useful also to enter a few very simple programs to show how easy it is to do this.

Once the simplicity of use is well-established, the next step is to demonstrate the power of the system. Use canned programs to show specific educational benefits. Stick to these canned programs or create your own. Be sure you have PAPER TAPES of these programs ready for fast loading. If you try to type them in in front of the customer he may get bogged down wondering how each program works. The following pages describe each of the available demo programs. These are the ones included on the tape labeled "EDUSYSTEM 10 DEMO TAPE".

There is also an EduSystem 10 Supplementary Demo Tape, which contains four more demos. These are:

OPTION

D 1) DECWRITER - an alternate version which uses no multiple statements per line.

G 2) EDU-BARD - a poetry writing program

G 3) HAMURABI

F 4) ROCKET - the moon landing

But remember, these are for a completely set of circumstances. Do not even use them with the naive prospect. They are very tightly coded and hard to understand. And worse still, each each requires a specific set of functions. You cannot run all four without reloading and readjusting functions.

Therefore, use these supplementary demos where you will only have the chance to run one program anyway. If you want to show a variety of programs, use the regular demos. They can all be run with a single function setting. Of course, they're not as much fun as the supplementary ones....

(Exact instructions for using the supplementary demos are on the front of the tape itself.)

DEMO NON-PROGRAM #0 Calculator Mode

OBJECT: To show the customer the extreme simplicity of the system. To show that complete novices can get meaningful results from the computer, and gain confidence in their ability right from the start.

DESCRIPTION: This is a sample of a calculator-mode demo. Substitute your own examples if you wish.

USAGE: Show how calculator mode lets you use the computer without even writing a program.

```
PRINT 2+3
PRINT 2+3, 2-3, 2*3, 2/3, 2↑3
```

Show the functions which are available make the system a powerful calculating tool.

```
PRINT SQR(5)
```

Emphasize the speed with which BASIC performs monstrous calculations.

```
PRINT 5.7*(2-SQR(6.9)↑2+4.2/SIN(2.8))
```

Introduce the customer to the idea of stored variables.

```
LET P = 3.14159
LET R = 4
PRINT P*R↑2
```

One of the most powerful features of the system is its ability to put multiple statements on a single line. Statements on the same line are separated by a back slash (\ ). Show how this capability allows loops and iterations to be performed in calculator mode.

Editor's Note:
"\" is SHIFT/L

```
FOR I = 1 TO 10\ PRINT SQR(I),\ NEXT I
```

Now show how easy it is to write a simple program. (If the customer knows BASIC, this demonstration should be skipped.) A program to input the sides of a right triangle and calculate the hypotenuse is a good sample program. It may be typed in quickly and its meaning is obvious even to a non-programmer.

```
10  INPUT A,B
20  LET C = SQR (A↑2+B↑2)
30  PRINT "HYPOTENUSE IS"; C
40  GOTO 10
50  END
```

EDUCATIONAL BENEFITS:	EduSystem 10 is easy to get started with. You don't have to be an expert in order to get meaningful results. EduSystem 10 will be in use the day it arrives in a school.

DEMO PROGRAM #1 CONVERGE

OBJECT:

To show the math teacher how EduSystem 10 allows him to better teach the material he is teaching anyhow. It does this by performing massive calculations quickly.

DESCRIPTION:

The CONVERGE program will calculate:

1) e by infinite geometric series
2) π by inscribed and circumscribed polygons
3) π by infinite arithmetic series

These methods are commonly taught, but rare is the student who has gained experience in them by actually calculating them out.

USAGE:

Load CONVERGE and type RUN. The program asks which calculation you want. Type N if you don't want to do that one; type Y if you do. The program types out successive approximations until stopped by typing the 'S' key.

Important Note: When π is being calculated by infinite series, the program types out only every 500th value. Thus, each value typed out corresponds to 8 pages of typeout, which would be produced if each step in the approximation were typed.

LIMITATIONS:

Requires that SIN and COS be loaded. Runs with all but ATN loaded.

EDUCATIONAL BENEFITS:

The most important lesson that the student learns is the relative swiftness with which these approximations converge. The first two, which are geometric series, draw the bead very quickly. The third is very slow, even at computer speeds. After 2 1/2 hours (and 500,000 iterations) it is still working on the 5th decimal place. This slowness demonstrates the difference between a convergence based on an arithmetic progression and one based on a geometric progression. Without the computer, few students really get to understand this important concept.

OTHER EXAMPLES:

There are many other examples where EduSystem 10's calculating ability brings concepts to life which are otherwise buried under endless calculations. Among them:

1) integration by Simpson's rule
2) compound interest
3) calculations based on many random numbers

DEMO PROGRAM #2 ROOT FINDER

OBJECT: To show the math teacher how EduSystem 10 allows him to teach material that is impossible to teach without the computer. It does this by allowing students to concentrate on the method, or algorithm and letting the computer do the calculations.

DESCRIPTION: ROOT finds all the roots of a function (ANY FUNCTION!) between -20 and 20. The function may be quadratic, cubic, trigonometric or any combination. Algebra 1 students learn how to solve linear and quadratic equations, but for most students, this is the limit of their capabilities. The method used here involves evaluating the function at incremental values, finding places where the value of the function changes sign and then, by successive approximations, finding the zero point. This method is similar to the commonly taught "Newton's Method."

USAGE: Type SCRATCH to delete any previous program, then load ROOT. Before typing RUN, enter the function to be evaluated as a DEF FNA(X) statement as line 100. Then type RUN. For example:

```
100 DEF FNA(X) = 2*X↑3+11*X↑2-31*X-180

100 DEF FNA(X) = SIN(X)-.5

100 DEF FNA(X) = X-4
```

LIMITATIONS: Requires that the DEF function be available plus any functions which are used in the DEF statement itself. Runs with all functions but ATN loaded. The program is coded to look for solutions only between -20 and 20. It could just as easily look at any other interval. ***Note*** Each time a new function is given, the constants in it are added to BASIC's constant table. Eventually, this table may overflow. In this case, type SCRATCH and reload the program.

EDUCATIONAL BENEFITS: The average student (especially in high school) does not have a thorough understanding of the very important concept of solving a function, much less an ability to do so for functions of any complexity. The computer lets them become very knowledgeable and confident in this area. In fact, at Lexington (Mass.) High School, freshmen algebra students are expected to be able to solve any function. Only the availability of a computer makes this level of learning possible.

OTHER EXAMPLES:	Another important area of modern mathematics is the study of random processes. Without a computer to generate and manipulate large volumes of random numbers, a meaningful study of random numbers is just plain impossible.

DEMO PROGRAM #3 GOLDBACH

OBJECT: To show how the computer can be used as a learning tool in math. More important, to show how EduSystem 10 may be used in conjunction with the new series of math texts now becoming available. This program and the descriptions below are taken from Chapter 25 of CAMP's First Course book.

DESCRIPTION: This is the description of the program exercise as it appears in the CAMP text (page 200).

"Goldbach's Conjecture is one of the famous unproved theories in mathematics. Many people have searched for a counter-example to prove that the following claim is false: Every even number E greater than four is the sum of two odd prime numbers. Study the program "Goldbach" which will print out each even number E, where $E \leq 6 \leq 50$, and two odd prime numbers whose sum is E. Examine the output from the computer. Does this program "prove" the conjecture.

The teacher's guide is quick to point out that it proves the conjecture for $E \leq 50$, but that's all.

USAGE: Load Goldbach and type RUN. No input is required

LIMITATIONS: Uses no functions. Runs with all but ATN loaded. Slow. This program has nested loops which take time. Running time is in minutes.

EDUCATIONAL BENEFITS: The student has whole new ways to approach theorem proving when the computer is available to try lots of cases.

The important point about this program is that it demonstrates the connection between EduSystem 10 and the CAMP text. Each supports the other.

DEMO PROGRAM #4 3DPLOT

OBJECT: To show the power of the computer for plotting and visualizing physical phenomena.

DESCRIPTION: 3DPLOT will plot a three dimensional, perspective graph of a function of three variables. It plots Z (the vertical axis) as a function of X and Y, where X and Y are inside a circle of radius 30.

USAGE: Type SCRATCH, then load the program. Enter the function to be plotted as a DEF FNA(Z) statement in line 5. Then type RUN. The resulting plot will go sideways on the page. For a demonstration plot of an exponential, use the DEF which is preloaded into the program.

LIMITATIONS: Requires that SQR be loaded plus any functions used in the DEF. Runs with all functions but ATN loaded. Like all plotting programs, some functions come out "prettier" than others. Two that are known to work are:

```
5 DEF FNA(Z) = 30*EXP(-Z*Z/100)

5  DEF FNA(Z) = SQR (900.01-Z*Z)*.9 -2
```

The constants are "fudge factors" to make the plot come out right. Plotting random curves with this program might be ungood.

EDUCATIONAL BENEFITS: Using the computer to plot is an excellent way to teach coordinate geometry. It really shows the interrelation of geometry and algebra as described by Descartes.

OTHER EXAMPLES: EduSystem 10 can, of course, also do the more routine forms of 2-dimensional plotting.

5 DEF FNA(Z) = 30*(cos (Z/16))↑2

5 DEF FNA (Z) = 30-30* SIN (Z/18)

5 DEF FNA (Z) = 30*EXP(-cos (Z/16))-30
(Bessel function - Sommerfeld's Integral)

5 DEF FNA (Z) = 30 * SIN (Z/10)

DEMO PROGRAM #5 EVOLU

OBJECT: To show the science teacher how EduSystem 10 can simulate a lab experiment which would take too long to do in real life. Also to show how the computer allows the student to control parameters which he couldn't control in real life.

DESCRIPTION: The EVOLU program demonstrates the effects of genetic mutations of a sample of 10000 pepper moths. These mutations cause a small number of these moths to become somewhat light in tone. However, it takes many years for this effect to show up, making it impossible to show in a school lab. In addition, the program allows the student to vary the mutation rate and to change the environment midway in the experiment.

USAGE: Type SCRATCH to delete any previous program, then load EVOLU. Type RUN. When asked, enter the mutation rate (from 1 to 10), the year in which the environment is to change (3 to 10) and whether the environmental change will favor light (type an L) or dark ones (type a D). The program then prints out the course of evolution over a thirty year period.

LIMITATIONS: Uses no functions, but will run with all but ATN loaded. Gives unpredictable results if the input values are not within the limits described in the section on usage.

EDUCATIONAL BENEFITS: Where else can a student observe a thirty year reproductive cycle and watch the effects of mutations? More important, where else can the student repeat the cycle, trying new parameters and conditions?

This experiment illustrates the computer's ability to answer the vital question: "What if?" In a regular lab, the student barely has time to run through an experiment once. At the end he may ask "Supposing I had changed one input parameter?" Without the computer, he either runs the entire experiment again or, far more likely, forgets the whole thing. The computer, by answering the "What if?" question immediately, encourages this kind of intellectual curiosity.

OTHER EXAMPLES: Many other common science experiments take a long time to run, or require the student to run it several times. To get meaningful results, it may often be simulated on the computer.

DEMO PROGRAM #6 PHOTO-ELECTRIC EFFECT

OBJECT: To show how the computer may be used to "simulate" expensive laboratory equipment. To show that the computer lets the physics teacher do more lab work at lower cost.

DESCRIPTION When light of short wave-length falls on a metal surface, electrons are ejected from the metal. According to the description of this phenomenon by Einstein, there is a maximum wavelength for each metal above which no electrons are emitted. This program lets the user find this critical wave-length.

USAGE: The program simulates the actual experiment, where the metal is placed in a vacuum and bombarded with soft X-rays. The number of electrons ejected is collected and counted by means of an ammeter. The program types out three ammeter readings for each wave-length. After this has been done, the intensity may be increased and the experiment re-run. The typed out values could then be graphed to show the critical wavelength.

To pick a metal enter its coefficient as follows:

Silver	.308
Bismuth	.338
Cadmium	.318
Lead	.340
Platinum	.385

LIMITATIONS: Requires that the SQR function be loaded. Runs with all functions but ATN loaded.

EDUCATIONAL BENEFITS: Students very rarely get to work with the same concepts that Einstein worked with, or indeed with any of the great 20th century work in physics. The reason is simple: modern physics uses laboratory gear that is way beyond the means of most schools. The concepts themselves are often easy enough for the student; it is only the lack of equipment that holds him down. As this program demonstrates, the computer can fill this gap by simulating equipment. And unlike most lab equipment which is used with one unit, then lies idle the rest of the term, a computer does all kinds of things all year long. Its flexibility means it is never idle.

DEMO PROGRAM #7 KINEMA

OBJECT:	1) To show how EduSystem 10 may be used in physical science courses, as well as mathematics. 2) To show the usefulness of the computer as a motivation and reinforcement tool in traditional courses and curricula.
DESCRIPTION:	The KINEMA program tests the student's knowledge of kinematics. A ball, or any other object, is thrown up at a certain velocity (in meters per second.) The student is then asked to calculate certain information about the resulting trajectory. The computer then checks the response to see if it is within 15%.
USAGE:	Load KINEMA, then type RUN. Then try to answer the questions. Distances should be entered in meters, time in seconds, and velocity in meters per second (plus for up, minus for down.) Type the 'S' key to terminate.
LIMITATIONS:	Requires that the random number function be available. Runs with all functions but ATN loaded.
EDUCATIONAL BENEFIT:	The key educational benefit here is the powerful motivating force that the computer has. The work that the student is being asked to do is really no different than rote homework exercises. But the computer makes it a challenge. It is very frustrating to have a dumb computer keep telling you you're wrong. Try it yourself and see if it doesn't make you want to brush up on your physics. That's real motivation.
OTHER EXAMPLES:	EduSystem 10 can provide this type of reinforcement and drill for a wide variety of subjects, from simple number facts on up.

DEMO PROGRAM #8 DEPRECIATE

OBJECT:	To show how the computer may be used in the business department.
DESCRIPTION:	This program shows how a piece of capital equipment depreciates according to three commonly used depreciation methods: straight line, sum of the digits, and double declining.
USAGE:	Load the DEPRECIATE program and type RUN. Enter the purchase price of the item, its life in years, and its scrap value at the end of that time.
LIMITATIONS:	Uses no functions. Runs with all but ATN loaded.
EDUCATIONAL BENEFITS:	The study of "general business" is often just the study of a lot of tables in a textbook. It's hard for a student to get involved in this work, since he often doesn't understand what is behind these tables. The computer can bring many of these topics to life. Also, by having some exposure to a computer, the student learns to be comfortable with it. He will be much better prepared for work in a modern business.

DEMO PROGRAM #9 PAY-SCALE

OBJECT:	To show the computer doing something of direct interest to the teacher and administrator himself.
DESCRIPTION:	Pay-Scale calculates the pay scale for a school. The user may vary the inputs and then see the actual pay scale that results.
USAGE:	Load PAY-SCALE, then type RUN and answer the series of questions. The program then types out the pay scale.
LIMITATIONS:	Does not require any functions. Runs with all but ATN loaded.
EDUCATIONAL BENEFITS:	Not really. This program relates more to school operation than to curriculum. It is, however, a good, straight-forward example of a BASIC program which might be used to illustrate how easy it is to program in BASIC.

DEMO PROGRAM #10 DECWRITER

OBJECT:	To provide an interesting typeout pattern which can run continuously when the computer is not actually being used.
DESCRIPTION:	DECWRITER prints out INTERACTIVE BASIC in a continuous sine wave. Inside each wave the DEC initials are typed out.
USAGE:	Load DECWRITER, then type RUN. The program will run until stopped by typing the S key.
LIMITATIONS:	Requires that the SIN function be loaded. Runs with all functions but ATN loaded. Uses multiple statements per line.
EDUCATIONAL BENEFITS:	None. This program is not designed to demonstrate anything. It is useful at the times when the computer would otherwise be idle, such as while people are coming in for a seminar.

CONVERGE

```
100 PRINT
110 Y=1
120 N=2
130 PRINT "COMPUTE E (Y OR N)";
135 INPUT Z
140 IF Z=Y THEN 500
145 PRINT "COMPUTE PI BY POLYGONS";
150 INPUT Z
155 IF Z=Y THEN 200
160 PRINT "COMPUTE PI BY SERIES";
165 INPUT Z
170 IF Z=Y THEN 600
175 STOP
200 K=K+1
210 N=3*2↑K
220 N1=3.14159/N
230 PRINT COS(N1)*N*SIN(N1)
240 PRINT N*TAN(N1)
250 GO TO 200
500 E=1
510 I=I+1
520 D=1
530 FOR J=1 TO I
540 D=D*J
550 NEXT J
560 E=E+1/D
570 PRINT E
580 GO TO 510
600 S=1
610 I=1
620 Q=Q+1
630 P=P+S/I
640 I=I+2
650 S=-1*S
660 IF Q<499 THEN 620
670 Q=0
680 PRINT P*4
690 GO TO 620
```

ROOT FINDER

```
100 DEF FNA(X)=X↑4+X↑3-31*X↑2+71*X-42
110 Z1=-200
120 FOR I=-19.9 TO 20
130 IF SGN(FNA(I))=SGN(FNA(I+1)) THEN 300
140 K=I
150 J=I+1
160 IF FNA(K)<FNA(J) THEN 200
170 Z=K
180 K=J
190 J=Z
200 Z=(K+J)/2
210 IF FNA(Z)<0 THEN 240
220 J=Z
230 GO TO 250
240 K=Z
250 IF ABS(FNA(Z))>5.000000E-05 THEN 200
260 Z=SGN(Z)*INT(ABS(Z)*10000+.5)/10000
270 IF Z=Z1 THEN 300
280 PRINT "F("Z")=0"
290 Z1=Z
300 NEXT I
310 END
```

```
5 PRINT "GOLDBACH"
10 FOR E=6 TO 50 STEP 2
15 FOR P=3 TO E-3
20 FOR F=2 TO P-1
25 IF P/F=INT(P/F) THEN 65
30 NEXT F
35 FOR N=3 TO E-3
40 FOR D=2 TO N-1
45 IF N/D=INT(N/D) THEN 60
50 NEXT D
55 IF P+N=E THEN 80
60 NEXT N
65 NEXT P
70 PRINT "CONJECTURE FALSE FOR"E
75 GO TO 99
80 PRINT E"="P"+"N
85 NEXT E
99 END
```

3DPLOT

```
5 DEF FNA(Z)=30*EXP(-Z*Z/100)
40 PRINT
45 I1=1
50 FOR X=-30 TO 30 STEP 1.5
60 L1=-1
70 Y1=5*INT(SQR(900.01-X*X)/5)
80 FOR Y=Y1 TO -Y1 STEP -5
90 Z=INT(25+FNA(SQR(X*X+Y*Y))-.7*Y)
100 IF L1=-1 THEN 140
110 IF Z>L1 THEN 180
120 IF Z<L2 THEN 150
130 GO TO 200
140 L1=Z
150 L2=Z
160 IF Z=I1-1 THEN 166
161 FOR I=I1 TO Z
162 PRINT " ";
164 NEXT I
166 PRINT "*";
167 I1=Z+2
170 GO TO 200
180 L1=Z
190 GO TO 160
200 NEXT Y
210 PRINT
215 I1=1
220 NEXT X
230 PRINT
240 END
```

```
210 PRINT
215 PRINT "ENTER RATE OF MUTATION (1 TO 10)";
220 INPUT M
250 P0=10000
260 Z=P0
450 PRINT "YEAR IN WHICH ENVIRONMENTAL CHANGE OCCURS";
460 INPUT X
464 L=1
466 D=2
470 PRINT "CHANGE FAVORS LIGHT MOTHS OR DARK (ENTER L OR D)";
480 INPUT E
580 PRINT
582 PRINT "YEAR","DARK MOTHS","LIGHT MOTHS"
584 PRINT
610 FOR T=1 TO 30
620 IF T>=X THEN 650
630 P1=0
640 GO TO 710
650 IF E<>2 THEN 630
660 P1=INT(P1+.01*M*P0+.5)
670 P0=INT(Z-P1+.5)
680 IF P1<Z THEN 710
690 P1=Z
700 P0=0
710 PRINT T,P1,P0
720 NEXT T
999 END
```

```
100 PRINT
110 PRINT "ENTER CO-EFFICIENT FOR METAL";
120 INPUT V0
460 K=INT(1+2*RND(X))
470 PRINT
480 PRINT " ","MEASURED CURRENT (MICRO-AMPERES)"
490 PRINT "WAVELENGHTH","TRIAL 1","TRIAL 2","TRIAL 3"
500 FOR L=.42 TO .25 STEP -.02
510 M=INT(1000/L)
520 PRINT M,
530 FOR J=1 TO 3
540 IF L>V0 THEN 570
550 I=SQR(INT(25*RND(X)))
560 GO TO 580
570 I=SQR(K*K*100+INT(35*RND(X)))
580 N=INT(10*I+.5)/10
590 PRINT N,
600 NEXT J
610 PRINT
620 NEXT L
                                        (1 FOR YES, 2 FOR NO)";
625 PRINT
630 PRINT "INCREASE LIGHT INTENSITY (Y OR N)";
                                      1     2
~~640 Y=1~~
~~650 N=2~~
660 INPUT Q2 Y
          Y2
670 IF Q2=N THEN 999
690 PRINT "BY WHAT FACTOR (1 TO 10)";
700 INPUT F
720 K=K*F
730 GO TO 470
999 END
```

```
100 PRINT
105 PRINT
106 Q=0
110 V=5+INT(35*RND(0))
111 PRINT "A BALL IS THROWN UPWARDS AT"V"METERS PER SECOND"
112 PRINT
115 A=.05*V↑2
116 PRINT "HOW HIGH WILL IT GO (IN METERS)";
117 GOSUB 500
120 A=V/5
122 PRINT "HOW LONG UNTIL IT RETURNS (IN SECONDS)";
124 GOSUB 500
130 T=1+INT(2*V*RND(1))/10
132 A=V-10*T
134 PRINT "WHAT WILL ITS VELOCITY BE AFTER"T"SECONDS";
136 GOSUB 500
140 PRINT
150 PRINT Q"RIGHT OUT OF 3.";
160 IF Q<2 THEN 100
170 PRINT "  NOT BAD."
180 GO TO 100
500 INPUT G
502 IF ABS((G-A)/A)<.15 THEN 510
504 PRINT "NOT EVEN CLOSE...."
506 GO TO 512
510 PRINT "CLOSE ENOUGH."
511 Q=Q+1
512 PRINT "CORRECT ANSWER IS"A
520 PRINT
530 RETURN
999 END
```

```
120 PRINT "ORIGINAL COST";
130 INPUT C
140 PRINT " LIFE OF ITEM";
150 INPUT L
160 PRINT "  SCRAP VALUE";
170 INPUT S
180 PRINT
190 PRINT "YEAR","STRAIGHT","SUM OF"," DOUBLE"
200 PRINT " ","  LINE","DIGITS","DECLINING"
210 PRINT
220 V=C-S
230 D1=V/L
240 Y=((L+1)/2)*L
250 Z=L
260 FOR X=1 TO L
270 D2=V*(Z/Y)
280 Z=Z-1
290 D3=2*C/L
300 C=C-D3
310 PRINT X,
312 Q=D1
314 GOSUB 400
316 Q=D2
318 GOSUB 400
320 Q=D3
322 GOSUB 400
325 PRINT
330 NEXT X
350 STOP
400 Q=INT(Q*100)/100
420 IF Q>100 THEN 440
430 PRINT " ";
440 IF Q>10 THEN 460
450 PRINT " ";
460 PRINT "$"Q,
490 RETURN
999 END
```

```
100 PRINT "STARTING B.A. SALARY";
110 INPUT F
120 PRINT "DIFFERENCE BETWEEN B.A. AND BA+16";
130 INPUT G
140 PRINT "DIFFERENCE BETWEEN STEPS";
150 INPUT H
160 PRINT "NUMBER OF BACHELOR STEPS";
170 INPUT J
180 PRINT "NUMBER OF MASTER STEPS";
190 INPUT K
200 PRINT "ADDED RAISE FOR TENURE";
210 INPUT T
230 PRINT "STEP","B.A.","BA+16"
240 PRINT
250 FOR N=1 TO J
260 IF N<>4 THEN 290
270 F=F+T
290 PRINT N,F+H*(N-1),F+G+H*(N-1)
300 NEXT N
310 PRINT
320 F=F-T
330 PRINT
340 PRINT "STEP","M.A.","MA+16","MA+32"
350 PRINT
360 FOR M=1 TO K
370 IF M<>4 THEN 400
380 F=F+T
400 PRINT M,
410 FOR Q=2 TO 4
420 PRINT F+G*Q+H*(M-1),
430 NEXT Q
440 PRINT
450 NEXT M
460 PRINT
470 END
```

```
100 V=.7\FOR M=1 TO 63\GOSUB 200 \PRINT \NEXT M\GO TO 100
200 I=M\V=V+.1\X=INT(25+25*SIN(V))
210 IF I>=14 THEN 250 \X=X-33
250 GOSUB 400 \FOR J=0 TO X\PRINT " ";\NEXT J\PRINT "INTERACTIVE BASIC";
300 IF I<36 THEN 490 \IF I>=46 THEN 490
330 I=I-32\FOR Y=0 TO 10-X\PRINT " ";\NEXT Y\GOSUB 400 \RETURN
400 IF I>=14 THEN 490 \PRINT "    ";
415 IF I<4 THEN 495 \IF I=4 THEN 500 \IF I=5 THEN 510 \IF I=6 THEN 520
420 IF I=7 THEN 530 \IF I=8 THEN 540 \IF I=9 THEN 540
430 IF I=10 THEN 530 \IF I=11 THEN 520 \IF I=12 THEN 510
440 IF I=13 THEN 500 \RETURN
490 RETURN
495 PRINT "                             ";\RETURN
500 PRINT "******     *******    *****  ";\RETURN
510 PRINT "*******    *******   ******* ";\RETURN
520 PRINT "**    **   **        **    **";\RETURN
530 PRINT "**    **   **        **      ";\RETURN
540 PRINT "**    **   *****     **      ";\RETURN
```